

WHAT IS CLAIMED IS:

1. A method of manufacturing a semiconductor device for forming an MIM capacitor over a substrate, said MIM capacitor comprising a metal lower electrode having
5 an extending main part, and a plurality of fins laterally extending relative to said main part, said MIM capacitor further comprising a metal upper electrode, and a dielectric film held between said upper electrode and said lower electrode, wherein
at least one of said plurality of fins farthest from said substrate, and said main part, are formed by the same process.
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2. The method according to claim 1, wherein
said lower electrode extends upwardly from said substrate, and
said upper electrode surrounds said lower electrode.
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3. The method according to claim 1, wherein
all of said plurality of fins and said main part are formed by the same process.
4. The method according to claim 1, comprising the steps of:
depositing a plurality of first insulating films and a plurality of second
20 insulating films in alternate layers;
performing anisotropic etching on said plurality of first insulating films and
said plurality of second insulating films in alternate layers, to create a first opening
penetrating said plurality of first insulating films and said plurality of second insulating
films;
25 performing etching in said first opening in such a manner that said first

insulating film is etched at a higher etching rate relative to said second insulating film, to form a second opening where an end surface of said first insulating film is recessed relative to an end surface of said second insulating film; and

filling said second opening with a first metal film, to form said main part and
5 said plurality of fins.

5. The method according to claim 4, further comprising the steps of:

creating a third opening to surround said main part and said plurality of fins;
and

10 depositing a dielectric film and a second metal film in said third opening, to be stacked in this order relative to said first metal film.

6. The method according to claim 5, wherein

a third metal film, said dielectric film, and said second metal film are deposited
15 in said third opening, to be stacked in this order relative to said first metal film, said first insulating film, and said second insulating film, and

said first metal film and said third metal film together are operative to serve as
said lower electrode.

20 7. The method according to claim 1, comprising the steps of:

depositing a plurality of insulating films and a plurality of metal films in
alternate layers;

performing anisotropic etching of said plurality of insulating films and said
plurality of metal films in alternate layers, to create an opening penetrating said plurality
25 of insulating films and said plurality of metal films; and

filling said opening with another metal film, to form said main part.

8. A method of manufacturing a semiconductor device, comprising the steps of:
providing a second insulating film on a first insulating film;

5 creating a first opening penetrating said first insulating film and said second
insulating film;

providing a first metal film to fill said first opening;

widening said first opening to create a second opening; and

10 depositing a dielectric film and a second metal film in said second opening, to
be stacked in this order relative to said first metal film.

9. The method according to claim 8, wherein
said second opening exposes said first insulating film.

15 10. The method according to claim 8, wherein
said second opening has a bottom defined in said second insulating film, and
said first metal film protrudes from said bottom of said second opening.

11. The method according to claim 8, wherein
20 said second opening penetrates said first insulating film and said second
insulating film.

12. The method according to claim 8, wherein
an insulating film is provided to a sidewall of said first opening, and
25 said second opening is created by removing said insulating film.

13. The method according to claim 8, wherein

a third metal film, said dielectric film, and said second metal film are deposited
in said second opening, to be stacked in this order relative to said first metal film and said
5 second insulating film, and

said first metal film and said third metal film together are operative to serve as
a lower electrode of a capacitor.

14. The method according to claim 9, wherein

10 a third metal film, said dielectric film, and said second metal film are deposited
in said second opening, to be stacked in this order relative to said first metal film and said
second insulating film, and

said first metal film and said third metal film together are operative to serve as
a lower electrode of a capacitor.

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15. The method according to claim 10, wherein

a third metal film, said dielectric film, and said second metal film are deposited
in said second opening, to be stacked in this order relative to said first metal film and said
second insulating film, and

20 said first metal film and said third metal film together are operative to serve as
a lower electrode of a capacitor.

16. The method according to claim 11, wherein

a third metal film, said dielectric film, and said second metal film are deposited
25 in said second opening, to be stacked in this order relative to said first metal film and said

second insulating film, and

said first metal film and said third metal film together are operative to serve as a lower electrode of a capacitor.

5 17. The method according to claim 12, wherein

a third metal film, said dielectric film, and said second metal film are deposited in said second opening, to be stacked in this order relative to said first metal film and said second insulating film, and

said first metal film and said third metal film together are operative to serve as
10 a lower electrode of a capacitor.

18. A method of manufacturing a semiconductor device, comprising the steps of:

creating a first opening and a second opening wider than said first opening in an
15 insulating film, said first opening penetrating said insulating film, said second opening having a bottom in said insulating film; and

depositing a first metal film, a dielectric film, and a second metal film, to be stacked in this order in said first opening and said second opening, wherein

said second metal film is operative to serve as an upper electrode, and
20 at least said first metal film in said second opening is operative to serve as a lower electrode.